

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Kevin A. Seiling

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Composite Decking

Assistant Commissioner for Patents
Washington, DC 20231

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DECLARATION OF TIMOTHY M. LAHER

Now comes Timothy M. Laher, an individual, who resides at 1214 West Tenth Street, Erie, Pennsylvania, and who declares the following facts are true, complete and correct:

1. I hold a Bachelor of Science degree in Chemistry from Vanderbilt University and a Doctor of Philosophy in Chemistry degree from the University of Mississippi. I held two different postdoctoral positions in the Chemistry Department at the University of Tennessee (Knoxville, TN). In these two positions, I had extensive experience with the development of industrial practices (patentable research projects with ALCOA, ARCO and DuPont). My areas of expertise include industrial chemistry, surface chemistry, computational chemistry, and analytical chemistry. I have presented my work at a number of regional and national conferences for the past 20 years. I am a recognized expert in these areas by fellow professionals in these fields of study. I have been also involved in the professional review of work submitted for publication in these areas. Over this period of time I have over 20 publications in these areas.

2. I am currently a tenured professor of Chemistry at Gannon University (Erie, PA). I have been a member of the department faculty at Gannon University since 1989. I have served as an expert consultant for a number of local industries (Erie, PA) in the area of surface treatment, much of this involving the study of polymer interaction with surfaces,

and thus, have acquired a considerable expertise in polymer science and structure. I have been a member of the American Chemical Society for the past 25 years.

3. I have been involved in the research of the chemical characterization of surfaces, and polymer surface coatings and surfactants (both in terms of chemical analysis and computational characterization of chemical substances via the use of molecular mechanics and quantum mechanics) commonly manufactured. Through this experience and background, I am knowledgeable in the chemical properties of polymeric materials, especially in regard to those properties that differentiate seemingly related polymeric substances

4. I have investigated the chemical differences between the polymers known as Polyvinyl Chloride (PVC) and Chlorinated Polyvinyl Chloride (CPVC) and have found the following differences in chemical properties.

a. Polyvinyl chloride (hereafter referred to as PVC) is a polymer that consists of repeating units of the monomer vinyl chloride (formula C_2H_3Cl as shown in diagram 1 below), terminated at the ends by the units CH_3 and CH_2Cl .

b. Chlorinated polyvinyl chloride (hereafter referred to as CPVC) is a copolymer that consists of some monomer units of vinyl chloride which are intermittently separated by monomer units of vinylidene chloride (formulas of C_2H_3Cl and $C_2H_2Cl_2$, respectively as shown in diagram 2 below), terminated at the ends by the units CH_3 and $CH_2Cl/CHCl_2$, depending on formulation). The ratio of the two monomers does not necessarily have to be equal, but in most formulations the ratio is very nearly so, and usually the polymeric chain alternates between the two monomer units.

Diagram 1: low order structure of PVC



Diagram 2: low order structure of CPVC



c. Both PVC and CPVC can be made from the respective monomer formulations described in statement 2 above by means of catalytic cationic initiated polymerization (this is always done with the manufacture of PVC and also done with what is termed the prefabrication process for CPVC). An additional process (termed the post-fabrication process for CPVC) can be used to formulate CPVC from PVC which involves the free radical chlorination of PVC to convert some of the vinyl chloride monomer units into vinylidene chloride monomer units.

d. The single hydrogen on the carbon bearing chlorine is more reactive than either hydrogen on a carbon bearing only hydrogens, as is found with the vinyl chloride monomer unit. This will make PVC (which contains carbons bearing one hydrogen and one chlorine) generally more reactive towards reagents capable of abstracting hydrogen than CPVC (in which has vinylidene chloride monomer units where there a carbons which contain only two hydrogens or two chlorines), as PVC consists only of the vinyl chloride monomer.

e. There are additional differences between PVC and CPVC which result from the addition of the vinylidene monomer unit to formulate the CPVC copolymer. These differences result from the additional polarity introduced by the addition of chlorine to the vinyl chloride monomer unit to produce the vinylidene chloride monomer unit.

f. There are additional differences between PVC and CPVC which result from the addition of the vinylidene monomer unit to formulate the CPVC copolymer. These differences result from the additional polarity introduced by the addition of chlorine to the vinyl chloride monomer unit to produce the vinylidene chloride monomer unit.

g. The polarity differences in the two monomer units has a strong effect on long range electrostatic interactions between different functional groups that are part of the low order structure of the polymeric chain in each case. These interactions result in a higher order structure (termed second order structure) for PVC and CPVC, respectively, which are marked different to each other. This sort difference in second order structure (and even higher order structure), which results in widely difference chemical and physical properties for what are, at first glance, seemingly similar substances. It is exactly these higher order structure differences, for example, in biochemical systems that make proteins (made up of the same basic monomer units) radically different from each other in terms of both structure and how they act in biological system.

h. In this particular case, PVC is found to have a very regular, highly-ordered second order structure. On the other hand, the second order structure for CPVC is far more irregular. Typically in polymers, a high degree in second order structure results in polymers with more rigidity (i.e., tend to be more crystalline), whereas a low degree of order results in polymers that tend to be more plastic and flexible. Thus, one would find considerable differences in the mechanical properties of these two seemingly similar polymer materials. From these considerations alone, it should be obvious that PVC and CPVC are certainly two quite different materials.

5. The differences outlined above in these properties clearly demonstrate that the two polymers are quite distinct and must be considered as different polymers. These differences (both from an analytical chemical perspective and a computational chemical

analysis) infer a substantially different structure of the polymers. Based upon my experience, education and expertise, I conclude that, based upon the chemical properties as given above, CPVC and PVC are different polymers. I further conclude that the chemical structural properties of PVC cannot be ascertained, predicted, or demonstrated from the chemical structural properties of CPVC to an extent reasonably beyond such prediction from the properties of other related polymers.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine and imprisonment, or both under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued there from.

Further I say not.


